Research Note

Muscicolous *Lepraria* species and other leprarioid lichens in the Antarctic*

ASTRI BOTNEN AND DAG OLAV ØVSTEDAL

Botnen, A. & Øvstedal, D. O. 1988: Muscicolous *Lepraria* species and other leprarioid lichens in the Antarctic. *Polar Research 6*, 129–133.

Antarctic muscicolous leprarioid lichens are examined chemically and morphologically. The species belong to *Lepraria*, *Lecidella* and *Lecanora*. *Crocynia nivea* Hue, *C. candidadissima* Hue and *Lepraria angardiana* Øvstedal are placed in synonymy with *Lepraria caerulescens* (Hue) Botnen & Øvstedal comb. nov. (syn. *Crocynia caerulescens* Hue), and the species is lectotypified. *Lepraria arctica* (Lynge) Wetmore is reported for the first time from the Antarctic and the southern hemisphere. Some non-leprose taxa are also discussed.

Astri Botnen, Botanical Institute, University of Bergen, Allégt. 41, N-5007 Bergen, Norway; Dag Olav Øvstedal, ARBOHA, University of Bergen, Allégt. 41, N-5007 Bergen, Norway; *November 1987 (revised March 1988).*

Moss cushions and turfs are important features of the Antarctic terrestrial vegetation. In dry habitats these mosses are often colonized by white, lime-green or grey, ecorticate, sorediate, usually sterile crusts. We refer to these lichens collectively as leprarioid, i.e. belonging to *Lepraria* or, at least, resembling that genus morphologically. The aim of this paper is to clarify the taxonomy of some of these crusts.

Hue (1908, 1915) described a number of *Lepraria*-species from the Antarctic. Vainio (1903) described two species from islands in the Gerlache Strait off the west coast of the Antarctic Peninsula: *L. straminea* Vain. and *L. pallidostraminea* Vain. The latter has been shown to be synonymous with *Haematomma erythromma* (Nyl.) Zahlbr. (Follmann & Rudolph 1970). Øvstedal (1983) described *Lepraria angardiana* from the continental Dronning Maud Land. Golubkova et al. (1968) reported *L. neglecta* (Nyl.) Erichs. from Western Enderby Land, East Antarctica. We have not had access to their material, and the species is therefore not discussed below.

Material and methods

The specimens examined were partly filed among unidentified Antarctic material in BM† and AAS, partly collected during Norwegian expeditions to Dronning Maud Land by J. Angard, Y. Gjessing, T. Engelskjøn and others, and deposited in BG. All specimens occurred on bryophytes or soil. Hue's type specimens were borrowed from PC, and Vainio's from TUR. Thin layer chromatography analyses were performed in accordance with the standard methods of Culberson (1972), modified by Menlove (1974).

Results

On the basis of morphological and chemical characters the following main groups were distinguished:

I. Thallus leprose throughout, or at least with a leprose surface.

Atranorin present.

This group contained 6 chemotypes:

1) atranorin, roccellic acid and porphyrilic acid,
2) atranorin, porphyrilic acid,
3) atranorin, roccellic acid,
4) atranorin, unknown fatty acid (Rf-classes 3/3/3),

* Scientific results of the Norwegian Antarctic Research Expedition 1984/85. Publication no. 96.

† Abbreviations of herbarium collections where the specimens are deposited according to the *Index Herbariorum*.

5) atranorin, unknown fatty acid (Rf-classes 3/3/3), rangiformic acid,
6) atranorin (trace), four unknown substances (probably dibenzo-furanes), one unknown fatty acid.

Three morphological uniform groups were distinguished:

Chemotypes 1–3: thallus white, unstratified, leprose; margin non-lobate. Diameter of the soredia was measured in four specimens, and the mean value and standard deviation (S.D.) were 149.6 ± 21.6 µm (n = 91).

Chemotypes 4–5: thallus with a ± bluish tinge, unstratified, margin non-lobate. Diameter of the soredia was measured in two specimens of chemotype 4, the mean value and S.D. were 142.9 ± 12.1 µm (n = 20). Superficially the texture is slightly coarser than the 1–3 unity.

Chemotype 6 (one specimen): thallus thicker than 1 to 5, stratified; surface grey-white, leprose; margin sublobate, medulla white. Mean diameter and S.D. of the soredia were 70.2 ± 4.7 µm (n = 10). The soredia were in texture similar to those of the previously mentioned groups.

II. Thallus leprose, unstratified, sterile. Xanthones present. Thallus yellowish grey, up to 2 cm diam., thin to medium thick; margin non-lobate; along thalline cracks the soredia showed a tendency to coalesce, giving the thallus a ± continuous appearance over small areas. Mean diameter and S.D. of the soredia (when not coalescent) were 85.6 ± 5.5 µm (n = 10).

III. Thallus with a leprose surface, stratified, sterile. No lichen compounds. Thallus white, up to 3 cm diam.; margin non-lobate; surface smooth, scabrid-leprose; medulla distinct, white. 'Soredia' variable in size, c. 100–800 µm diam.

Discussion

Compared with other groups of lichens, the lepraroid lichens have relatively few morphological characters by which species can be defined. The absence of cortical structures leave mainly such characters as degree of lobation, size and structure of soredia, and presence or absence of a medulla as diagnostic characters. The degree of lobation and development of a medulla may vary within the species, and are characters of somewhat limited usefulness. Chemical constituents seem, on the other hand, to be of great taxonomic value.

The genus *Lepraria* Ach. (nomen conservandum with the type *L. incana* (L.) Ach.) is a heterogeneous assemblage of sterile species with at least the surface completely dissolved into soredia. The chemistry of *Lepraria* is diverse and the compounds are distributed among several major classes of natural products: higher aliphatic acids, para-depsides of both the orcinol and the β-orcinol series, β-orcinol depsidones and dibenzo-furanes. *Lepraria* s. str. (excluding the bright-yellow species of *Chrysothrix* (see Laundon 1981) and *Leproplaca* (Laundon 1974)) is not known to produce pigments (e.g. xanthones, anthraquinones, pulvinic acid derivatives and usnic acids).

Main group I fits with this concept of *Lepraria*. Chemotypes 1–3 differ from chemotypes 4–5 only in colour. A statistical t-test was performed on the diameter and standard deviation of the soredia within the groups 1–3 and 4–5, with the null-hypothesis that they belong to the same taxon. On the 0.01 level, the null-hypothesis could not be rejected. Specimens lacking roccellic acid (chemotype 2) or porphyrilic acid (chemotype 3) may be regarded as representing acid deficient phases of chemotype 1, and specimens lacking rangiformic acid (chemotype 4) as an acid deficient phase of chemotype 5.

The range of *Lepraria* specimens, containing atranorin in large amounts, now available from Antarctica, has convinced us that for the time being it is best to regard them all as part of one chemically variable species.

The oldest names for this Antarctic species are: *Crocynia candidadissima* Hue, *C. caerulescens* Hue and *C. nivea* Hue (Hue 1915). The type of *C. candidadissima* contains atranorin and porphyrilic acid, while *C. nivea* and *C. caerulescens* were found to have atranorin and roccellic acid. The type material of these species also fits well within the morphological range of the Antarctic material.

The largest and best developed of the type-specimens is one of the syntypes of *Crocynia caerulescens* Hue. We therefore select this specimen as the type of *C. caerulescens* Hue and transfer the species to *Lepraria: Lepraria caerulescens* (Hue) Botnen & Øvstedal comb. nov. Basionym: *Crocynia caerulescens* Hue (1915: 11–12). Lectotype: Antarctic Peninsula, West Graham Land, Booth-Wandel Island, 30 December 1908, no. 125 (PC! here selected). (This lectotypification of the species is also suggested by

Lamb in a herbarium note and in an unpublished manuscript kept with the British Antarctic Survey.)

Synonyms: *Crocynia nivea* Hue (Hue 1915:9. Holotype: Antarctic Peninsula, West Graham Land, Cap des Trois-Perez, no. 273, 6 March 1909, PC!)
Crocynia candidadissima Hue (Hue 1915:7. Holotype: Antarctic Peninsula, West Graham Land, Peterman Island, no. 144, Liouville leg., 1 January 1909, PC!)
Lepraria angardiana Øvstedal (Øvstedal 1983:687. Holotype: Antarctica, Dronning Maud Land, H. U. Sverdrupfjella, Sørhausane, J. Angard leg., 31 December 1970, BG!)

The type of the latter name contains atranorin, roccellic and porphyrilic acids.

The relationship between *Lepraria* species in the Antarctic and the northern hemisphere is uncertain, since the taxonomy of the genus is strongly in need of a modern revision. There is a possibility that *L. caerulescens* may prove to be identical with material from the northern hemisphere, for which even older names may exist.

Main group I, chemotype 6, contains most of the unknown compounds (including the major ones) found in Scandinavian and Arctic populations of *Lepraria arctica* (Lynge) Wetmore (T. Tønsberg pers. comm.). The Antarctic specimen is also morphologically similar, and we therefore identify this entity with *L. arctica*, a species which is an addition to the Antarctic flora, and apparently also to the southern hemisphere.

Main group II includes leprarioid specimens containing xanthones. Xanthones are unknown in *Lepraria*. We assign the species representing this group tentatively to *Lecidella*, a genus which includes leprose-sorediate species with xanthones as common chemical constituents.

Main group III includes leprarioid specimens with no TLC-detectable chemistry. No species of *Lepraria* is known to be lichen acid deficient. We assign this species to *Lecanora expectans* Darb., which is similar in morphology, chemistry and habitat, but is known as fertile, and of which the type also has been studied (Øvstedal 1986).

Non-leprose taxa

The presently studied material of Antarctic muscicolous lichens included some specimens which at first sight seemed to be leprarioid, at least with respect to morphology, but which, on closer examination were found to contain cortical structures.

A group of sterile specimens with a thallus consisting of yellowish, corticate granules contained usnic acid and zeorin. These specimens were found to be morphologically and chemically similar to *Lepraria straminea* Vain. (TUR), described from the Gerlache Strait of the Antarctic Peninsula. Possibly, this species should be transferred to *Haematomma*.

Another group had a greyish white thallus with small, coherent, corticate areas and contained triterpenes. On closer examination of some of the specimens, apothecia of two types were found: 1) hypothecium pale brown; spores dark brown, 1-septate, 23–27 × 11–12.5 µm (2 specimens), 2) hypothecium colourless; spores colourless, simple, c. 18 × 11 µm (one specimen). The specimens with 1-septate spores were identified with *Buellia papillata* (Sommerf.) Tuckerm. (Øvstedal unpublished), a species previously recorded from the Antarctic (Lamb 1968:98), and the specimen with unseptate spores is a *Lecidea* s.lat., the identity of which is under investigation.

Finally one specimen had a sterile, white, coherent, partly corticate thallus with a rugose surface, chemical content gyrophoric and lecanoric acids. This species is similar in all essential details to the North European *Ochrolechia frigida* (Sw.) Lynge, a species which is common throughout the maritime Antarctic.

Key to the species

1 Thallus at least partly corticate 2
1 Thallus completely ecorticate 5

2(1) Thallus containing only triterpenes 3
2 Thallus not containing only triterpenes... 4

3(2) Apothecia with dark, two-celled spores ..... *Buellia papillata*
3 Apothecia with uncoloured, simple spores . ..... *Lecidea* s. lat. sp.

4(2) Thallus containing usnic acid and zeorin .... *'Lepraria' straminea*
4 Thallus containing gyrophoric and lecanoric acids..... *Ochrolechia frigida*

5(1) Thallus without secondary lichen products . ..... *Lecanora expectans*
5 Thallus with secondary lichen products... 6

6(5) Soredia 140–170 µm in diam..... ..... *Lepraria caerulescens*
6 Soredia 60–90 µm in diam..... 7

7(6) Thallus containing two xanthones..... ..... *Lecidella* sp.
7 Thallus containing four unknown compounds, unknown fatty acids and trace of atranorin ..... *Lepraria arctica*

Localities of investigated material

Buellia papillata (Sommerf.) Tuckerm.

1. Dronning Maud Land, Vestfjella, Basen, 28 January 1985, S. Olaussen leg. (BG, 2 collections).
2. East Graham Land, James Ross Island, 1945, I. M. Lamb leg. (BM).

Lecanora expectans Darb.

1. Dronning Maud Land, Vestfjella; Mühlig-Hofmannfjella, Gjelsvikfjella (many specimens, BG).

Lecidea s. lat. sp.

1. Gjelsvikfjella, Jutulsessen, N, E, nunatak 1250, 16 January 1985, T. Engelskjøn leg. (BG).

Lecidella sp.

1. West Graham Land, Marguerite Bay, Neny Island, 23 February 1967, R.I.L. Smith no. 813 (AAS).
2. West Graham Land, Marguerite Bay, Pourquoi-Pas Island, March 1981, R. I. L. Smith, no. 4778B (AAS).

Lepraria arctica (Lynge) Wetmore

1. South Georgia, north side of Moltke Harbour, Royal Bay. On moss in dry sheltered overhangs of cliff, alt. 10 m, 24 January 1972, D. C. Lindsay, no. 4043 (AAS).

Lepraria caerulescens (Hue) Botnen & Øvstedal

a) With atranorin, porphyrilic and/or roccellic acid (selected localities):
1. Antarctic Peninsula, West Graham Land, Booth-Wandel Island, 30 December 1908, no. 125 (PC) (lectotype of *Crocynia caerulescens* Hue, TLC: atranorin and roccellic acid).
2. Antarctic Peninsula, West Graham Land, Galindez Island, 'Penola' Exped., 1934–37, 17 December 1935, no. 1321a (BM).
3. Dronning Maud Land, Vestfjella, Mühlig-Hofmannfjella, Gjelsvikfjella (many specimens, including holotype of *Lepraria angardiana* Øvstedal (BG)).
4. Antarctic Peninsula, West Graham Land, Alexander Island (several collections, R. I. L. Smith, nos. 2690, 2699, 2732 (all AAS)).
5. Antarctic Peninsula, West Graham Land, Adelaide Island, 16 February 1977, R. I. L. Smith, no. 2309 (AAS).

b) With atranorin and unknown fatty acid (Rf-classes 3/3/3):
1. Dronning Maud Land, Gjelsvikfjella, Jutulsessen, Hamarskaftet, height 1745, 13 February 1985, T. Engelskjøn leg. (BG).
2. Dronning Maud Land, Gjelsvikfjella, Jutulsessen, Armlenet, 31 January 1985, B. Tørudbakken leg. (BG, 2 specimens).
3. Dronning Maud Land, H. U. Sverdrupfjella, Brekkerista, O. Wilson leg. (UPS, BG).

c) With atranorin, unknown fatty acid (Rf-classes 3/3/3) and rangiformic acid:
1. Dronning Maud Land, Mühlig-Hofmannfjella, Plogskaftet, height 1623 N, 8 February 1985, T. Engelskjøn leg. (BG).

'Lepraria' straminea Vain.

1. Antarctic Peninsula, West Graham Land, Galindez Island, 'Penola' Exped. 1934–37 no. 1342, 2 January 1936 (BM).
2. Antarctic Peninsula, Gerlache Strait, Danco Island (holotype, see Vainio 1903).

Ochrolechia frigida

1. Dronning Maud Land, Gjelsvikfjella, Jutulsessen, Hamarskaftet, 13 February 1985, T. Engelskjøn leg. (BG).

Acknowledgements. – We are greatly indebted to the persons and curators who supplied us with material, to Dr. P. M. Jørgensen, Bergen, for comments on the manuscript, to Dr. R. I. Lewis Smith, Cambridge, for supply of material, comments on the manuscript and giving us access to I. M. Lamb's unpublished manuscript, and to T. Tønsberg, Bergen, for information about *Lepraria arctica* and comments on the manuscript.

References

Culberson, C. F. 1972: Improved condition and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *J. Chromatog. 72*, 113–125.

Follmann, G. & Rudolph, E. D. 1970: *Haematomma erythromma* (Nyl.) Zahlbr. in der Antarktis. *Willdenowia 6*, 13–16.

Golubkova, N. S., Savich, V. P. & Simonov, I. M. 1968: Lichens from Western Enderby Land. *Trans. Sov. Ant. Exp. 38* (in transl. by Israel Progr. Scient. Trans. Jerusalem 1969), 249–255.

Hue, A. M. 1908: Lichens. Pp. 1–17 in *Expéd. Antarct. Française (1903–1905), Sciences naturelles, Documents scientifiques*. Masson et Cie, Paris.

Hue, A. M. 1915: Lichens. Pp. 1–202 in *Deux. Expéd. Antarct. Française (1908–1910), Sciences naturelles, Documents scientifiques*. Masson et Cie, Paris.

Lamb, I. M. 1968: Antarctic lichens: II. The Genera *Buellia* and *Rinodina*. With an ontogenetic section by A. Henssen. *Brit. Antarctic Survey Sci. Rep. 61*, 1–129.

Laundon, J. 1974: *Leproplaca* in the British Isles. *Lichenologist 6*, 102–105.

Laundon, J. 1981: The species of *Chrysothrix*. *Lichenologist 13*, 101–121.

Menlove, J. 1974: Thin-layer chromatography for the identification of lichen substances. *Bull. Brit. Lichen. Soc. 34*, 77–83.

Øvstedal, D. O. 1983: Some Lichens from H. U. Sverdrup Mountains, Dronning Maud Land, Antarctica. *Nova Hedwigia 37*, 683–690.

Øvstedal, D. O. 1986: Lichens and lichen parasites from the British-Swedish-Norwegian Antarctic expedition 1949–52 to Dronning Maud Land. *Cryptogamie, Bryol., Lichénol. 7(1)*, 63–70.

Vainio, E. A. 1903: *Botanique. Lichens. Resultats du Voyage du S. Y. 'Belgica' en 1897–1898–1899*. Rapports Scientifique, Anvers. 42 pp.